SUPRA-VOICE SOUND-RESPONSIVE TOY

Cross Reference to Related Applications

[0001] The present application claims priority from United States Provisional Patent Application Serial No. 60/472,313, filed May 20, 2003, and incorporated herein by reference in its entirety for all purposes.

Background

[0002] The present disclosure relates generally to sound-activated toys, and particularly to toys that respond to sounds in one or more ranges of frequencies, such as sounds in a range of frequencies above frequencies of normal human speech.

[0003] Sound responsive toys with non-voice-recognition based circuits are found in U.S. Patent Nos. 3,119,201, 3,770,981, 4,207,696, 4,221,927, 4,775,351, 5,090,936, 5,176,560, 5,324,225, 5,407,376, 5,429,513, 6,039,626, and 6,413,141, the disclosures of which are incorporated herein by reference. Recognition based circuits are found in U.S. Patent Nos. 3,688,126, 4,780,906, and 4,817,155, the disclosures of which are incorporated herein by reference.

Summary

[0004] As mentioned, the present disclosure is directed to a toy that responds to sounds having a frequency range above the frequencies of normal speech. The toy may also respond to other sounds, such as sounds having frequencies corresponding to the frequencies of normal speech. In some embodiments, the toy is responsive to two or

more ranges of spaced-apart frequencies. In other words there may be a range of reject frequencies to which the toy is not responsive, which reject frequencies are between ranges of frequencies to which the toy responds. In some embodiments such a range of reject frequencies may include a range of normal human speech.

[0005] The toy may have advantageous use when embodied in the form of an action figure, such as a snake. In such an embodiment, the toy may be responsive to one or more frequency bands, and may have different reactions depending on the frequency bands detected.

Brief Description of the Drawings

[0006] FIG. 1 is a general block diagram of a sound-responsive toy.

[0007] FIG. 2 is a block diagram of a further embodiment of the toy of FIG. 1, which toy is responsive to different frequency ranges.

[0008] FIG. 3 is a schematic of a circuit usable in an embodiment of the toy of FIG. 2.

[0009] FIG. 4 is a table illustrating operating characteristics of the circuit of FIG. 3.

[0010] FIG. 5 is a chart illustrating graphically operating characteristics of the circuit of FIG. 3.

Detailed Description of an Embodiment

[0011] Referring initially to FIG. 1, a toy shown generally at 10, includes a body 11, a sound detector 12, and an output apparatus 14. Sound detector 12 and output apparatus 14 may be included in body 11. In some embodiments, sound detector 12 may be remote from the body, in which case body 11', shown in dashed lines, contains only output apparatus 14.

[0012] In this example, sound detector 12 is adapted to detect a sound in a range of frequencies above normal human speech. Normal human speech is generally considered to be in the range of 300 Hz to 3000 Hz. Rather, sound detector 12 detects sounds that are significantly above this usual range, referred to as supra-voice sounds, are detected and amplified. A range of frequencies can include a single frequency or a plurality of adjacent frequencies distributed between a low frequency and a high frequency.

[0013] Sound detector 12 can be of various forms, such as a circuit or a controller that includes a processor and a memory coupled to the processor for storing data and operating instructions. Such circuit or controller may be embodied as one or more of hardware, firmware, and software. A processor may be any device, such as a computer, microprocessor, or other logic unit adapted to receive sounds from a sound receiving device 15 and to control an output apparatus 14.

[0014] Sound detector 12 may produce one or more control signals, such as a control signal C, to output apparatus 14. Output apparatus 14 is adapted to produce a sensible action when sound is detected in the range of frequencies above normal human speech. A sensible action is an action that can be sensed by one of the human senses. Examples of sensible actions that a toy in the form of a snake may include moving a movable part of the snake body, such as a snake tongue, eye, tail or other body part, illuminating lights positioned in the eyes, or making a sound, such as a hissing sound. The toy may produce one or several of such actions in response to control signal C.

[0015] FIG. 2 illustrates an example of a toy 10 adapted to respond to two different ranges of sounds. A sound detector 12 includes a sound receiver 15 and a sound analyzer 16. Sound receiver 15 includes a microphone 18 and a pre-amp 20. Microphone 18 is adapted to transduce sound of a broad frequency range including a normal voice range and a range above the normal voice range, i.e., a supra-voice range, into an electrical current or sound signal S. Pre-amp 20 then amplifies the sound signal to a convenient level for further processing.

[0016] The sound signal output from the pre-amp is split into a supra-voice path 26 and a second path 28. In the supra-voice path 26, the conditioned received sound signals are transmitted to a filter 30. In an embodiment in which the frequency range detected on path 26 is higher than that of path 28, filter 30 is a high-pass filter. The filtered sound signal is amplified by an op-amp 32 to raise the sound signal level.

[0017] Filter 30 thus essentially filters out the normal voice sounds of a person speaking into microphone 18. The high-frequency sounds are then applied to an amplitude detector 34. The amplitude detector puts out a control signal with a high value when the sound signal in the pass band of filter 30 is sufficient. The amplitude detector produces a control signal C_S indicative of the receipt of a supra-voice sound. The control signal is then applied to a first action device 36, and any other associated output apparatus that performs a sensible action by toy 10.

[0018] Sound signals traveling along voice path 28 pass through a low pass filter 38 and an op-amp 40. The pass band of filter 38 filters out of the sound signal frequencies in the pass band of filter 30 in order to provide a distinction between two different ranges of sounds. In one embodiment of circuit 10, filter 38 allows normal human voice frequencies to pass.

[0019] Similar to signal path 26, the filtered sound signal is then applied to an amplitude detector 42. Amplitude detector 42 produces a control signal C_V indicative of the receipt of a sound in the pass band of filter 38. The control signal is then applied to a second action device 44 that performs a designated action by toy 10 that is preferably different than an action produced by action device 36.

[0020] FIG. 3 is a schematic of a circuit usable in toy 10 of FIGS. 1 and 2, and includes a sound detector 12 and an output apparatus 14. Sound detector 12 includes a

sound receiver 15 in the form of a microphone 18 and pre-amp 20, and a sound analyzer 16.

[0021] Pre-amp 20 is shown as a two-stage amplifier having first and second transistors 22 and 24, although it also may be provided by an op-amp. The output of the pre-amp is identified as TP1. Representative values for the gain applied to a detected sound are shown in the table of FIG. 4, which data is represented as a graph in FIG. 5. The amplifier is seen to have a broad bandwidth or frequency range extending from sub-audible frequencies to frequencies well above frequencies normally audible to humans. This frequency range has a 3 dB bandwidth of about 150 Hz to about 3 kHz, with a maximum gain at about 1 kHz. Signal gain is provided over a total range of about 10 Hz to about 300 kHz.

[0022] A sound signal S, output by the sound detector, is applied to sound analyzer 16. The sound signal is split into a supra-voice path 26 and a second path 28, which in this embodiment is a voice path. In the supra-voice path 26, the conditioned received sound signal is transmitted to a high-pass filter 30 having a 3 dB pass band of about 7 kHz to 15 kHz and a peak at about 10 kHz. This is a frequency band that is outside the 3 dB pass band of the sound receiver, so it is amplified by an op-amp 32 to bring the center frequency up to a gain level similar to that applied to the pass band of pre-amp 20. The gain curve for the signals output from op-amp 32 is identified as TP3 in the table and chart in FIGS. 4 and 5.

[0023] Filter 30 thus essentially filters out the normal voice sounds of a person speaking into microphone 18. The high-frequency sounds are then applied to an amplitude detector 34 including an op-amp 46 and a transistor 48, shown in FIG. 3. If the signal output from op-amp 46 is large enough, transistor 48 is turned on. This transistor then produces a control signal C_S at the collector indicative of the receipt of a supra-voice sound. The control signal is then applied to a first action device, represented generally at 36, or other output apparatus, that performs a designated action by toy 10. In the circuit shown, the action device is a light-emitting diode (LED) 50 that emits a distinctive color, such as red. This light may be used, for instance, to illuminate an eye when the toy is in the form of an action figure, such as a snake.

[0024] Sound signals traveling along voice path 28 pass through a low pass filter 38 and an op-amp 40. The resulting filtered sound signal is identified as TP2 in the figures. It is seen that this filter has a pass band of about 200 Hz to 1500 Hz, and a peak at about 800 Hz. This pass band thus allows lower common voice frequencies to pass, while suppressing higher frequencies.

[0025] Similar to signal path 26, the low-frequency sounds are then applied to an amplitude detector 42, including an op-amp 52 and a transistor 54. If the signal output from op-amp 52 is large enough, transistor 54 is turned on. This transistor then produces a control signal C_V at the collector indicative of the receipt of a voice sound. The control signal is then applied to an action device 44 that performs a designated action by toy 10

that is preferably different than an action produced upon receipt of a supra-voice signal. In this example, the action device is an LED 56 that emits a distinctive color, such as yellow. Any other action that is sensible, or combination of sensible actions may be performed.

[0026] Between the pass bands of filters 30 and 34 is essentially a suppressed or reject band 58. This band is between the frequencies of about 1.5 kHz and about 7 kHz and has comparatively steep edges. The suppression of band 58 reduces the likelihood that the sounds having frequencies in this band will result in activation of both supra-voice and voice triggered action devices. Further, in order to activate the voice-activated action device 44, it is necessary to speak with a lower voice. There is thus substantial contrast between the sounds that activate action device 44 and the sounds that activate action device 36, thereby decreasing the likelihood that they will both be activated at the same time, although it is possible to do so.

[0027] Although not specifically shown, logic circuits may be applied to the outputs of the amplitude detectors, to produce different actions depending on whether only a voice signal or only a supra-voice signal is received, or both types of signals are received. As an example, if both types of signals are received, related or coordinated actions could be produced, such as moving the same toy part in different ways or moving different parts connected together.

[0028] Even though the supra-voice signals are above normal speech, it has been found that people can generate oral sounds in the pass band of filter 30 if enough energy is used in making the sounds. For instance, a pronounced and emphatic hissing sound made primarily by pushing air through the oral cavity while the oral cavity is nearly blocked by an enlarged tongue, by blowing through clenched teeth, or a combination of both, it is possible to produce sounds in this frequency band. It is therefore a challenge for people to make the toy activate the supra-voice-activated actions, and it is an even greater challenge to activate such actions without activating the voice-activated actions. This operation thus allows a user of the toy to "speak" a "language" understood by the toy that is not understood in normal human speech. This is analogous to the ability of the fictional character Harry Potter to speak to a parsle-mouthed snake.

[0029] It is intended that the disclosure set forth above encompasses multiple distinct inventions with independent utility. The specific embodiments disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. For instance, components having shared functions may be embodied in separate components and components having separate functions may be embodied in components having shared functions. The subject matter of the inventions includes all novel and non-obvious combinations and subcombinations of the various elements, features, functions and/or properties disclosed herein. Similarly, where the disclosure recites "a" or "a first" element or the equivalent thereof, such language should be understood to include one or more such elements, neither requiring nor excluding two or more such elements. Further,

cardinal indicators, such as first, second or third, for identified elements are used to distinguish between the elements, and do not indicate a required or limited number of such elements, nor does it indicate a particular position or order of such elements unless otherwise specifically stated.

[0030] Inventions embodied in various combinations and subcombinations of features, functions, elements, and/or properties may be claimed through presentation of claims in a related application. Such claims, regardless of their scope, are regarded as included within the subject matter of the present disclosure.